Coms 331 **The Modelview Matrix** **Fall 2007**

Homework 8

1. Matrix multiplication is not commutative. That is, in general, the product $\mathbf{AB}$ is not the same as the product $\mathbf{BA}$. Verify this by multiplying the matrices

$$\mathbf{A} = \begin{pmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix} \text{ and } \mathbf{B} = \begin{pmatrix} 1 & 0 & 2 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{pmatrix}$$

   both ways. Are the results different?

2. However, in special cases, matrices may commute. For example, let

$$\mathbf{A} = \begin{pmatrix} 1 & 0 & 2 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{pmatrix} \text{ and } \mathbf{B} = \begin{pmatrix} 1 & 0 & 4 \\ 0 & 1 & 5 \\ 0 & 0 & 1 \end{pmatrix}.$$

   Verify that $\mathbf{AB} = \mathbf{BA}$.

3. Use the program `Lecture 8 Demo 1.cpp` in this and the following exercises. In the `display()` function, move the call to `glTranslatef()` to a position just beyond the call to `glScalef()`. Run the program. Is there a difference? Can you explain it?

4. Now move the call to `glRotatef()` to a position just beyond the call to `glTranslatef()` and run the program. Is there a difference? Can you explain it?

5. Now move the call to `glScalef()` to a position just beyond the call to `glRotatef()` and run the program. Is there a difference? Can you explain it?

6. Remove the geometric transformations that are in `display()` and replace them with the following. Beginning at the origin, translate to $(2, 0, 0)$ and draw a shiny red sphere. Then translate `from there` to $(-2, 0, 0)$ and draw a shiny green sphere. Then translate `from there` to $(0, 0, -2)$ and draw a shiny blue sphere.

7. Use a `for` loop to create a series of eleven shiny red spheres of radius 0.5, located at $(-5, 0, 0), (-4, 0, 0), \ldots, (5, 0, 0)$. The body of the `for` loop should contain a call to `glTranslate()` and a call to `glutSolidSphere()`.

8. In the `display()` function, comment out the call to `glLoadIdentity()` and run the program. What happens? Why? Now uncomment the function call.